POLYMERS

VISUAL CHEM CARDS

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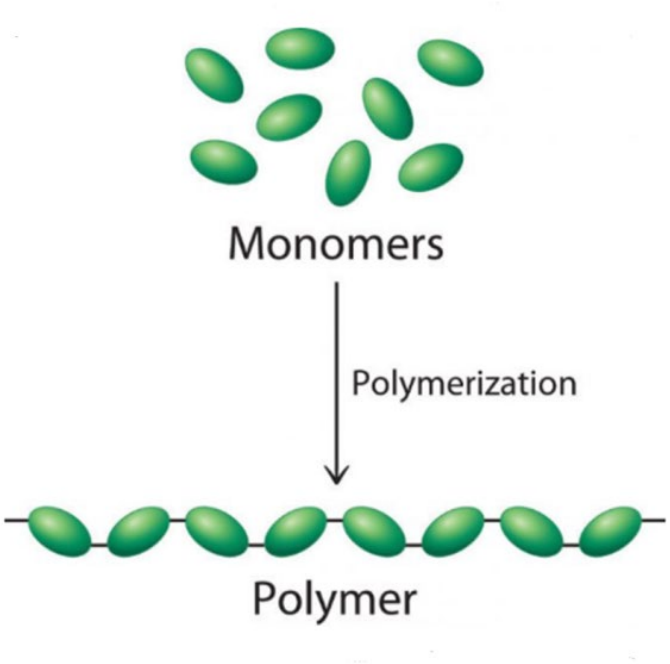
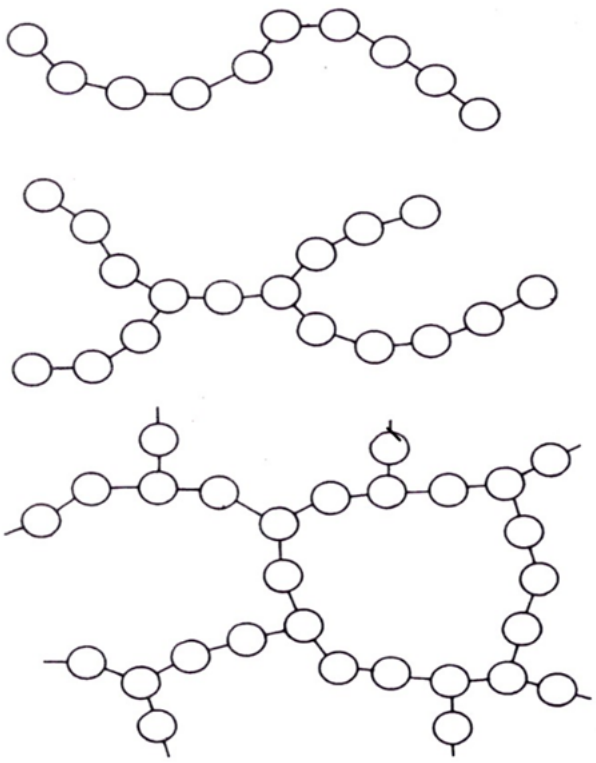
Polymers



During polymerisation large numbers of **monomers** become connected by covalent bonds to for a single long molecule – a polymer.

Polymers typically consist of 10,000-20,0000 monomers.



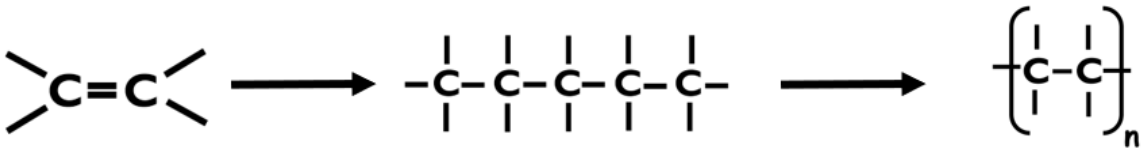
Linear polymer

Branched polymer

Cross-linked polymer

Polymers

Addition Polymers



alkene (unsaturated) — polyalkene (saturated)

MONOMER — POLYMER

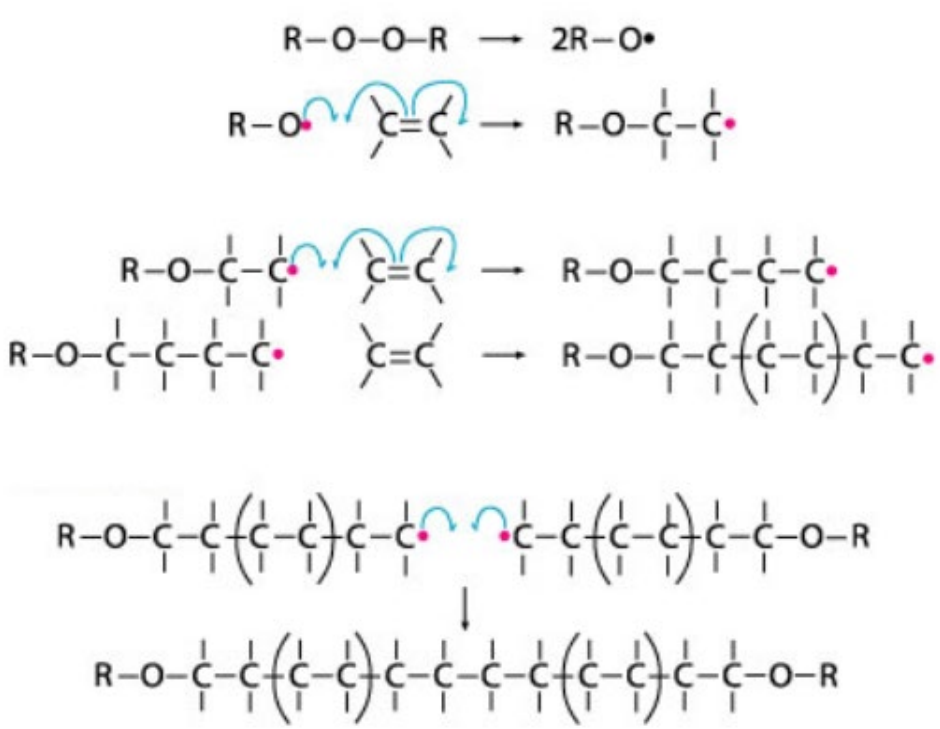
Monomers are joined together by C-C bonds formed by the sharing of C=C π electrons to form long chains (polymers).

Common Addition Polymers

Name(s)	Formula	Monomer	Uses
Polyethene	$-(CH_2\text{-}CH_2)_n-$	ethene $CH_2=CH_2$	film wrap, plastic bags
Polypropropene	$-[CH_2\text{-}CH(CH_3)]_n-$	propene $CH_2=CHCH_3$	carpet, upholstery
Poly(vinyl chloride) (PVC)	$-(CH_2\text{-}CHCl)_n-$	chloroethene $CH_2=CHCl$ (vinyl chloride)	pipes, bottles, flooring
Polystyrene (PS)	$-[CH_2\text{-}CH(C_6H_5)]_n-$	phenylethene $CH_2=CHC_6H_5$ (styrene)	toys, cabinets packaging (foamed)
Polyacrylonitrile (PAN, Orlon, Acrilan)	$-(CH_2\text{-}CHCN)_n-$	prop-2-enenitrile $CH_2=CHCN$ (acrylonitrile)	rugs, blankets clothing
Polytetrafluoroethene (PTFE, Teflon)	$-(CF_2\text{-}CF_2)_n-$	tetrafluoroethene $CF_2=CF_2$	non-stick surfaces

Polymers

Formation of Addition Polymers



Initiation step

Propagation step

Termination step

Three Step Process

Initiation step: formation of free radicals from an initiator (e.g. ROOR) by treatment with heat or light.

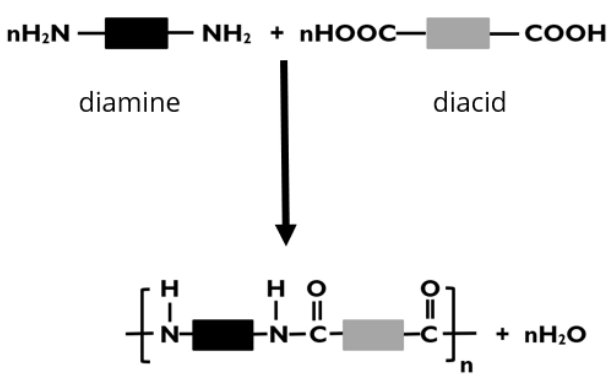
Propagation step: chain growth through the interaction of free radicals combine with monomer

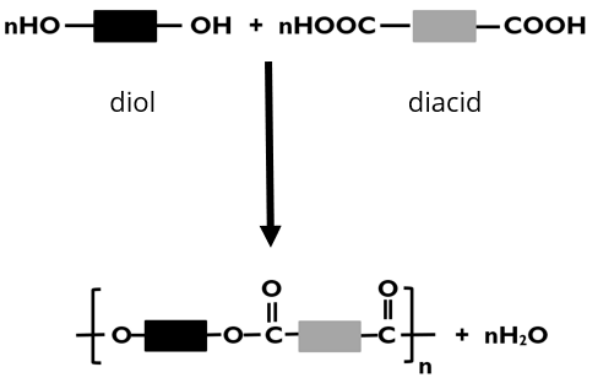
Termination step: occurs when two free radicals combine.

Free Radical: an atom, molecule, or ion that has an unpaired valence electron.

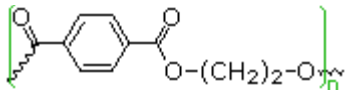
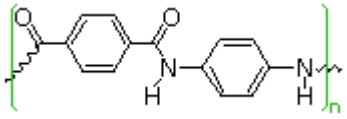
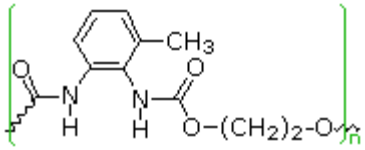
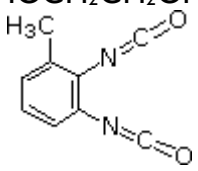
Polymers

Condensation Polymers





Some Everyday Condensation Polymers

Type	Formula	Monomers Components	Uses
polyester	~[CO(CH₂)₄CO-OCH₂CH₂O]ₙ~	HOOC-(CH₂)₄-COOH HO-CH₂CH₂-OH	fabrics
polyester PET		HOOC-C₆H₄-COOH HO-CH₂CH₂-OH	water bottles packaging
polyamide Nylon 66	~[CO(CH₂)₄CO-NH(CH₂)₆NH]ₙ~	HOOC-(CH₂)₄-COOH H₂N-(CH₂)₆-NH₂	fibres for textiles and carpets and molded parts
polyamide Kevlar		HOOC-C₆H₄-COOH H₂N-C₆H₄-NH₂	personal armour /protection musical instruments
polyurethane Lycra Spandex		HOCH₂CH₂OH 	clothing home furnishings